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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/596,373	12/16/2008	Aviram Tam	8873 USA P/PDC/CD-SEM/EZI	5794
57605	7590	10/13/2011	EXAMINER	
APPLIED MATERIALS, INC. c/o SNR DENTON US LLP P.O. BOX 061080 CHICAGO, IL 60606-1080			CESE, KENNY A	
			ART UNIT	PAPER NUMBER
			2624	
			MAIL DATE	DELIVERY MODE
			10/13/2011	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/596,373

Applicant(s)

TAM ET AL.

Examiner

KENNY CESE

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 21 July 2011.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 5) ☒ Claim(s) 1-15, 17-31, 34, 35, 37 and 38 is/are pending in the application.
- 5a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 6) ☒ Claim(s) 16, 32, 33 and 36 is/are allowed.
- 7) ☒ Claim(s) 1, 2, 4-15, 17, 18, 20-31, 34, 35, 37 and 38 is/are rejected.
- 8) ☒ Claim(s) 3 and 19 is/are objected to.
- 9) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 12) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)                        | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date ____. | 6) <input type="checkbox"/> Other: ____.  |

**DETAILED ACTION**

***Response to Amendment***

1. Applicants' response to the last Office Action, filed on 7/21/2011 has been entered and made of record.

***Response to Arguments***

2. Applicant's arguments with respect to claims 1-38 have been considered but are moot in view of the new grounds of rejection.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 1, 2, 4-9, 11-14, 17, 18, 20-25, 27-30, 34, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wenzel (US 2003/0194135) in view of Constantoudis et al. (Non-Patent Literature, titled, "Quantification of line-edge roughness of photoresists. II. Scaling and fractal analysis and the best roughness descriptors" April 25 2003; hereafter "Constantoudis").

Regarding claim 1, Wenzel discloses a method for evaluating a feature, comprising:

receiving an image of the feature (**see figure 8A and figure 8B and paras. 0187, where Wenzel discusses receiving geometric feature of an object in the image**);

determining respective coordinates of a plurality of points on an edge of the feature in the image **(see para. 342, where Wenzel discusses acquiring the coordinates of the sequence of points on a curve edge);**

fitting a figure having a non-circular and non-linear shape to the plurality of points **(see para. 0146, where Wenzel discusses determining a set of curves from the template figure image);**

thereafter determining respective distances between the plurality of points and the figure having the non-circular and non-linear shape **(see figure 8B and para. 0178, where Wenzel discusses comparing the discrete curve points of the target feature image with the discrete curve points of the template figure image and calculating a distance indicating the degree of difference between the feature target image and template figure image);** and

Wenzel discloses a curvature parameter for the feature using the distances **(see para. 0339, where Wenzel discusses applying the feature and template curvature distance difference calculation and applying it to the texture analysis)**. However, Wenzel does not disclose computing a roughness parameter for the feature using the respective distances. However, Constantoudis does **(see page 1020, where Constantoudis discusses computing edge roughness between distances of edge points at several positions)**.

Motivation to combine may be gleaned from the prior art contemplated. Therefore, one skilled in the art would have found it obvious from the teachings of Wenzel and Constantoudis as a whole to derive at the claimed invention in order to

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evaluate a roughness parameter by computing distances of curve edge points at several positions.

Regarding claim 2, Wenzel and Constantoudis teach wherein computing the roughness parameter comprises computing a contact edge roughness (CER) based on a sum of the squares of the respective distances and a number of degrees of freedom of the figure (**see para. 0215-0217, and 0339, where Wenzel discusses calculating sum of the squares of distances and degrees of freedom to calculate the curved edge matching calculation used in texture analysis; and page 1020, where Constantoudis discusses computing edge roughness between distances of edge points at several positions**).

Regarding claim 4, Constantoudis further teaches wherein computing the roughness parameter comprises performing a Fourier analysis of the respective distances, and generating a power spectrum based on the analysis (**see figure 3 and pages 1020-1021, where Constantoudis discusses performing a Fourier transform and generating a spectrum based on edge data**).

Regarding claim 5, Constantoudis further teaches wherein generating the power spectrum comprises filtering results of the Fourier analysis (**see figure 3 and figure 4 and pages 1020-1022, where Constantoudis discusses performing a spectrum responses based on Fourier transform and filtering**).

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Regarding claim 6, Constantoudis further teaches wherein filtering the results comprises selecting a filter based on a process used to form the feature **(page 1022, where Constantoudis discusses filter before the edge detection calculation)**.

Regarding claim 7, Wenzel and Constantoudis teach wherein the feature is formed on a substrate, and wherein the feature and the substrate are in a semiconductor wafer **(see para. 0345-0346, where Wenzel discusses applying the edge calculation to wafer manufacturing; and see page 1019, where Constantoudis discusses scanning patterns on substrates)**.

Regarding claim 8, Constantoudis further teaches wherein the feature comprises a contact hole **(see page 1019, where Constantoudis discusses scanning patterns on substrates)**.

Regarding claim 9, Constantoudis further teaches wherein receiving the image comprises generating the image with a scanning electron microscope **(see page 1019, where Constantoudis discusses using images from a scanning electron microscope)**.

Regarding claim 11, Wenzel discloses wherein the figure has a known shape **(see para.0377-0378, where Wenzel discusses the template figure having a known shape)**.

Regarding claim 12, Wenzel discloses wherein fitting the figure comprises determining a nominal shape of the figure by averaging at least some of the plurality of the points **(see para. 0167-0169, where Wenzel discusses normalizing a sequence of points for each curve by averaging the points)**.

Regarding claim 13, Wenzel discloses wherein the figure is a closed figure **(see figure 15 and para. 0245, where Wenzel discusses 3D closed curves)**.

Regarding claim 14, Wenzel discloses wherein the distance is a perpendicular distance or a radial distance **(see para. 0274, where Wenzel discusses curves that are perpendicular therefore the calculated distance is perpendicular)**.

Claim 17 is rejected as applied to claim 1 as pertaining to a corresponding apparatus.

Claim 18 is rejected as applied to claim 2 as pertaining to a corresponding apparatus.

Claim 20 is rejected as applied to claim 4 as pertaining to a corresponding apparatus.

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Claim 21 is rejected as applied to claim 5 as pertaining to a corresponding apparatus.

Claim 22 is rejected as applied to claim 6 as pertaining to a corresponding apparatus.

Claim 23 is rejected as applied to claim 7 as pertaining to a corresponding apparatus.

Claim 24 is rejected as applied to claim 8 as pertaining to a corresponding apparatus.

Claim 25 is rejected as applied to claim 9 as pertaining to a corresponding apparatus.

Claim 27 is rejected as applied to claim 11 as pertaining to a corresponding apparatus.

Claim 28 is rejected as applied to claim 12 as pertaining to a corresponding apparatus.

Claim 29 is rejected as applied to claim 13 as pertaining to a corresponding apparatus.

Claim 30 is rejected as applied to claim 14 as pertaining to a corresponding apparatus.

Regarding claim 34, Wenzel discloses a method for evaluating a feature, comprising:

receiving an image of the feature **(see figure 8A and figure 8B and paras. 0187, where Wenzel discusses receiving geometric feature of an object in the image);**

determining respective coordinates of a plurality of points on an edge of the feature in the image **(see para. 342, where Wenzel discusses acquiring the coordinates of the sequence of points on a curve edge);**

fitting a figure having a non-circular and non-linear shape to the plurality of points **(see para. 0146, where Wenzel discusses determining a set of curves from the template figure image);**

thereafter determining respective distances between the plurality of points and the figure having the non-circular and non-linear shape **(see figure 8B and para. 0178, where Wenzel discusses comparing the discrete curve points of the target feature image with the discrete curve points of the template figure image and calculating**

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**a distance indicating the degree of difference between the feature target image and template figure image).**

Wenzel does not disclose particularly disclose performing a Fourier analysis of the respective distances; and filtering results of the Fourier analysis based on a process used to form the feature. However, Constantoudis does **(see figure 3 and pages 1020-1021, where Constantoudis discusses performing a Fourier transform and generating a spectrum based on edge data).**

Regarding claim 35, Wenzel discloses a method for evaluating a feature, comprising:

receiving an image of the feature **(see figure 8A and figure 8B and paras. 0187, where Wenzel discusses receiving geometric feature of an object in the image);**

determining respective coordinates of a plurality of points on an edge of the feature in the image **(see para. 342, where Wenzel discusses acquiring the coordinates of the sequence of points on a curve edge);**

fitting a figure having a non-circular and non-linear shape to the plurality of points **(see para. 0146, where Wenzel discusses determining a set of curves from the template figure image);**

thereafter determining respective distances between the plurality of points and the figure having the non-circular and non-linear shape **(see figure 8B and para. 0178, where Wenzel discusses comparing the discrete curve points of the target feature**

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**image with the discrete curve points of the template figure image and calculating a distance indicating the degree of difference between the feature target image and template figure image).**

Wenzel does not disclose particularly disclose performing a Fourier analysis of the respective distances; and filtering results of the Fourier analysis based on a shape of the feature. However, Constantoudis does **(see figure 3 and pages 1020-1021, where Constantoudis discusses performing a Fourier transform and generating a spectrum based on edge data).**

Claim 37 is rejected as applied to claim 34 as pertaining to a corresponding apparatus.

Claim 38 is rejected as applied to claim 35 as pertaining to a corresponding apparatus.

6. Claims 10, 15, 26, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wenzel (US 2003/0194135) in view of Constantoudis and in further view of Miyano (US 6,480,807).

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Regarding claim 10, Wenzel and Constantoudis do not particularly disclose wherein the figure comprises an ellipse. However, Miyano does **(see col. 6 lines 25-28, where Miyano discusses an elliptic hole pattern)**.

Motivation to combine may be gleaned from the prior art contemplated. Therefore, one skilled in the art would have found it obvious from the teachings of Wenzel, Constantoudis, and Miyano as a whole to derive at the claimed invention in order to evaluate a roughness parameter by computing distances of curve edge points at several positions.

Regarding claim 15, Miyano wherein the feature is a reticle, a part of the reticle, or a cast of a structure **(see col. 5 lines 1-62 and col. 6 lines 29-39, where Miyano discusses scanning a wafer or portions of wafer in an electronic optical system)**.

Claim 26 is rejected as applied to claim 10 as pertaining to a corresponding apparatus.

Claim 31 is rejected as applied to claim 15 as pertaining to a corresponding apparatus.

***Allowable Subject Matter***

7. Claims 3 and 19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

8. The following is a statement of reasons for the indication of allowable subject matter: The prior art fails to teach computing a correlation length (CL) based on a sum of the squares of the respective distances, a number of degrees of freedom of the figure, and an average of squares of differences of the respective distances.

9. Claims 16 and 32 are allowed.

10. The following is an examiner's statement of reasons for allowance: Wenzel discloses a method for evaluating a feature, comprising: receiving an image of the feature; determining respective coordinates of a first plurality of points on a first edge of the feature in the image; and fitting a first figure having a first non-circular and non-linear shape to the first plurality of points. However, the prior art fails to teach fitting a second figure having a second non-circular and non-linear shape to the second plurality of points; thereafter determining respective distances between the first plurality of points and the first figure having the first non-circular and non-linear shape and respective distances between the second plurality of points and the second figure having the second non-circular and non-linear shape distances between the first and the second figures; and computing a roughness parameter for the feature in response to the respective distances.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

11. Claims 33 and 36 are allowed.

12. The following is an examiner's statement of reasons for allowance: Wenzel discloses a method for evaluating a feature, comprising: receiving an image of the feature; determining respective coordinates of a plurality of points on an edge of the feature in the image; fitting a figure having a non-circular and non-linear shape to the plurality of points; thereafter determining respective distances between the plurality of points and the figure having the non-circular and non-linear shape. However, the prior art fails to teach computing a correlation length based on a sum of the squares of the respective distances, a number of degrees of freedom of the figure, and an average of squares of differences of the respective distances.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

***Conclusion***

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

***Contact Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KENNY A. CESE whose telephone number is (571)270-1896. The examiner can normally be reached on Monday- Friday 8:00AM - 5:00PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vu Le can be reached on 571-272-7332. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Kenny A Cese/

Examiner, Art Unit 2624

/Vu Le/

Supervisory Patent Examiner, Art Unit 2624